

Position of hyoid bone in atypical deglutition –A pilot study

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ABSTRACT

Introduction: Position of the hyoid bone is a key factor in diagnosis of atypical deglutition in children under 12 years of age. **Objective:** The aim of the present study is to evaluate the position of hyoid bone among the subjects with atypical deglutition between the age group of 15-30 years. **Materials and Method:** 30 lateral cephalograms of subjects with atypical deglutition were selected as group A and 30 lateral cephalograms with normal deglutition (control group) were selected as group B. Linear measurements (H-MP, H-T distance) were measured manually on the lateral cephalograms. **Results:** values were compared using Mann-Whitney *U*-test and a *P*-value <0.05 was considered as statistically significant. The average distance of the H-MP was 7.10 mm for the group B and 8.97 mm for the group A. The average distance of the H-T variable was -2.63 mm for group B and -5.30 mm for the group A. **Conclusions:** Although statistically insignificant, the distance of H-MP and H-T were found to be more in group A than in the control group. This study shows a much lower and posterior position of hyoid bone in atypical deglutition patients.

Keywords: Atypical deglutition, Hyoid bone, Lateral cephalogram, Hypertonic

INTRODUCTION

Basically, three swallowing patterns have been described. They are visceral, somatic, and inconsistent swallow. The visceral or infantile swallow persists till 6 months of age as the tongue of the neonates are large and are located in the forward position, for their feeding and for anterior lip seal. At 6 months of age the incisors erupt and the position of the tongue changes from the forward position to the backward position. The period of 12-18 months is called the transitional period which is characterized by inconsistent

swallow with changes in tongue position and function. As the age progresses from 2-4 years, somatic or functionally balanced or mature swallow is observed in the children.^[7,10,12]

Swallowing is the first function to be established in the stomatognathic system and it is the last process to mature.^[7,12] If swallowing persists, it is believed to be a dysfunction or abnormality.^[7,12] Atypical deglutition has been attributed to sucking without nutritive purposes, use of feeding bottles, oral respiration, abnormalities of the central nervous system, and anatomical abnormalities.^[3-5]

The hyoid bone is considered to be an important structure in the neck region. Although it has no bony articulations it has many attachments to muscles, ligaments and fascia of the

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pharynx, mandible, and cranium. These muscle attachments, tongue, and mandibular movements together will affect the position of the hyoid bone. The hyoid bone position is widely used in diagnosis of deglutition disorders. Previous studies showed the descent of the hyoid bone may be related to speech and deglutition.^[21] Early descent of hyoid bone is due to the evolutionary development of speech and the late descent may be due to the conditions like obstructive sleep apnoea, mandibular set back surgeries, and airway patency.

Thus the position of the hyoid bone may be influenced by the habits such as tongue thrusting and breathing by mouth. Studies have been conducted with the aim of establishing the standard radiographic position of the hyoid bone in relation to the cranium^[12,13,15] and in cases of malocclusion,^[17,18,19] obstructive sleep apnoea,^[8,14-16] and oral respiration.^[5,6,9] However, no consensus has been reached in these studies.

This study aimed to evaluate the position of the hyoid bone using lateral cephalogram, among subjects with atypical deglutition.

MATERIALS AND METHODS

This was an observational study in which pretreatment lateral cephalograms of the patients who were diagnosed with atypical deglutition and patients with normal deglutition were collected. As this was a pilot study, the total sample size selected were 60 in which 30 samples are with atypical deglutition and 30 samples were with normal deglutition. For blinding the data, the sample was named as group A for atypical deglutition and group B for normal deglutition. Cephalometric tracing were done for all the 60 samples manually by a single operator to avoid any errors. The Cephalometric points considered in this study were H: hyoid (most anterosuperior point of the body of the hyoid bone), MP: mandibular plane (line from the midpoint of the mandibular angle to the lowest point on the outline of the mentonian symphysis), and T: tuber (line of intersection between the centre of the pterygomaxillary fissure and the posterior nasal spine). Lateral telerradiographs that did not provide a good view of the anatomical structures used in the cephalometric examination were excluded from the

study sample. Patients with dental agenesis, congenital poor orofacial formation, orthodontic, and/or functional orthopaedic treatment prior to the study, or doubts and imprecision regarding the diagnosis of deglutition were also excluded. The lateral telerradiographs from the experimental group and the control group were randomly put aside and numbered sequentially. The examiner performing the manual measurements was blinded to patient data. To compare H-MP and H-T measurements between the two groups, Mann-Whitney *U*-test was used. Descriptive data were presented as mean, standard deviation, and range and the significance levels of the test results were estimated. Wilcoxon test for related samples was used to detect possible differences between measurements obtained in two different occasions. The significance level used in the statistical tests was $P = 0.05$.

RESULTS

Mann-Whitney *U*-test was used to compare the two groups with regard to cephalometric measurements. The average distance of the H-MP was 7.10 mm for the group A and 8.97 mm for the group B, with a statistically insignificant difference ($P > 0.016$). The average distance of the H-T variable was -2.63 mm for group B and -5.30 mm for the group A. Cephalometric analysis of the linear measurement H-MP [Table 1] showed a mean difference of approximately 1 mm between the two groups, and the difference was 3 mm for the variable H-T [Table 2]. Both these differences were not statistically significant.

DISCUSSION

In infants, two functions are considered to be vital and are required for survival. They are respiration and deglutition. If these vital functions are imposed upon, then there will be compensation in the morphology and physiology. During the growing period the hyoid bone function emerges. At this stage during deglutition hyoid movement pattern is constantly reflecting the changes in tongue and in associated orofacial musculature. Insufficient functional stimulation of the stomatognathic system, especially the tongue is considered as the main factor in the persistence of childlike deglutition.^[12]

Table 1: Comparative analysis of the variable H-MP (millimeter).

Deglutition	n	Mean	SD	Min	Median	Max	P-value, mann-whitney
GROUP A (Normal)	30	7.10	5.9.10	0	7.50	25	0.251
GROUP A (Atypical)	30	8.97	4.838	0	8.00	25	

Table 2: Comparative analysis of the variable H-T (millimeter).

Deglutition	n	Mean	SD	Min	Median	Max	P-value, mann-whitney
GROUP A (Normal)	30	-2.63	6.280	-18	-2.50	10	0.113
GROUP A (Atypical)	30	-5.30	6.374	-18	-7.00	6	

The position of the hyoid bone mainly helps in the diagnosis of deglutition disorders.^[1] Three basic functions of the hyoid bone are deglutition, phonation, and respiration. Hyoid bone position is near or above the reference line connecting the third cervical vertebra and the most inferior portion of the chin when all teeth were erupted. Previous studies suggested that the maturational descent of the hyoid bone is thought to be closely related to speech and deglutition. Early descent of the hyoid bone is hypothesized to the evolutionary adaptation of speech development and is used to resonate the sound spectrum with the frequency of a harmonic. In contrast, late descent is readily observed in middle-aged or older men with obstructive sleep apnea or in patients after mandibular setback surgery and this might also be associated with airway patency, because airway resistance appears to increase with age or after the surgery.

As per previous studies it is believed that the lower and more posterior position of the hyoid bone in the group with tongue-related habits is due to muscle alterations and unbalance, which is mainly due to the muscles of the tongue. Swallowing is considered as the complex and coordinated function involving a large number of muscles, mainly the muscles of the tongue. It involves intrinsic muscles (inferior and superior, transversal, and vertical longitudinal muscle fibers) and extrinsic muscles. The extrinsic muscles of the tongue include genioglossus, styloglossus, palatoglossus, hyoglossus, and geniohyoid. There may be a possibility in alteration of tonicity. This possibility has already been observed in studies with ultrasonography. In atypical swallowing, the activity of the genioglossus muscle is increased and this explains the lower posture of the tongue in atypical swallowing. The geniohyoid and mylohyoid muscles were adequate of the distinction of visceral swallowing. This factor may be validated by the inferior and posterior position of the hyoid bone.

Previous studies suggests that there are no differences between control and experimental groups.^[2] H-MP position is found to be in inferior position of the hyoid bone in patients with atypical swallowing and there is an alteration of the suprahyoid and infrahyoid muscles (i.e., hypertonia of the suprahyoid and hypotonia of the suprahyoid muscles), so that there is altered posture of the tongue.^[12] H-T position is found to be in the anterior-posterior position of the hyoid bone in relation to the face. We have considered the descendant line of the pterygomaxillary fissure until the level of the hyoid bone as mark zero; distances to its right were measured as positive values and distances to the left of the mark zero were considered negative values. Therefore, the negative value of the H-T variable found in the group with atypical swallowing refers to the more posterior position of the hyoid bone in relation to the H-T line. An hypothesis which has already been studied is that the radiographic position of the hyoid bone is dependent of a facial type and associated to factors,

such as age, obesity, breathing, and apnoea.^[11,14] The lower and more posterior position of the hyoid bone is mainly due to the muscle alterations and unbalance, and is also mainly due to the muscles of the tongue.^[12] There is also a study with ultrasonography^[12] which describe that the atypical swallowing is mainly due to the activity of the genioglossus muscle that is responsible for the lowered posture of the tongue and the geniohyoid and mylohyoid is responsible for the inferior and posterior position of the hyoid bone. Previous study increases the possibility of achieving an objective diagnosis for this functional abnormality in case of mixed dentition.^[20] Although statistically insignificant, the distance of H-MP and H-T were found to be more in group A than in the control group. This study shows a much lower and posterior position of hyoid bone in atypical deglutition patients.

CONCLUSION

In case of H-MP distance, the mean difference of approximately 1 mm between the two groups was found for patients above the age group of 12-30 years. In case of H-T distance, the mean difference was found to be 3 mm above the age group of 12-30 years. Distances of H-MP and H-T in individuals with atypical deglutition when compared to normal individuals were not statistically significant above the age of 12 years. The radiographic position of the hyoid bone as useful information and that would help in the diagnosis of atypical deglutition in children below the age group of 12 year and not above it. This is only a pilot study and further requires more studies with more number of samples.

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Conflict of interest:

There are no conflicts of interest.

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